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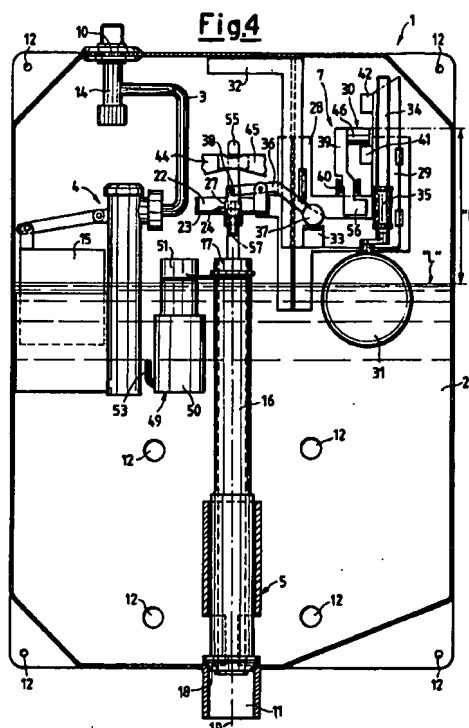
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(54) **Water-closet flushing cistern**

(57) To improve bowl cleaning and hygiene while substantially reducing water consumption, the cistern (1) comprises a hydraulic device (7) for causing early closure of the valving element (5), and an additive dispensing device (6) in which the operation of the two devices can be combined to obtain the following four flushing methods:

- using all the water contained in the container (2) of the cistern (1) plus an additive;
- using all the water contained in the container (2) of the cistern (1) but without the addition of an additive;
- using only a part the water contained in the container (2) of the cistern (1) plus an additive;
- using only a part of the water contained in the container (2) of the cistern (1) but without the addition of an additive.

All the flushing methods can also be operated remotely.



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Description

This invention relates to a water-closet flushing cistern.

The document FR-A-843,779 describes a water-closet flushing device, the main purpose of which is to evacuate the flushing water without this seeping through the operating button.

The document US-A-2,959,790 describes a flushing cistern shut-off valve more reliable than those commercially available at that time.

The document DE-A-30 03 654 describes a device which dispenses a disinfectant substance in a measured manner into the flushing water of the cistern to which it is applied. Its purpose is substantially to improve the flushing hygiene conditions by controlled doses of sanitizing substances.

The document DE-A-35 09 800 describes a unit applicable to a water-closet bowl which both flushes the bowl and evacuates the foul air which forms in its interior during use.

The document FR-A-2 592 667 relates to an installation which provides for substitution of the bowl seats and the delivery of a cleansing product with the flushing water.

Italian patent application 93A002314 dated 29 October 1993 describes a water-closet flushing cistern in which a system is provided for dispensing an additive into the flushing water. Patent application MI94/A001526 describes a further flushing cistern.

Briefly, in the aforesaid documents, flushing is implemented either with water or with water plus an additive, none of the said documents either being concerned with or teaching improved cleansing and hygiene of the bowl while substantially reducing water consumption, which as is well known is always abundant with every flush.

An object of this invention is therefore to improve the cleansing and hygiene of the bowl while substantially reducing water consumption. In more technical terms the object of the invention is to provide a flushing cistern able to deliver at choice two different flushing water flows, to each of said flushing water flows it being possible at choice either to add or not to add an additive which improves and facilitates cleansing and hygiene of the bowl while adapting water consumption to true requirements, and hence with a substantial final saving.

A further object of the invention is to provide a flushing cistern which is able to deliver at choice two different flushing water flows, to each of said flushing water flows it being possible at choice either to add or not to add an additive, and which operates totally hydraulically so as to be particularly reliable, in that its operation does not depend on a source of electrical energy.

A further object of the invention is to provide a cistern able to deliver at choice two different water flows, each of said water flows being able, at choice, to be operated either directly in proximity to the cistern, or at

a distance from the cistern.

A further object of the invention is to provide a cistern which attains the aforesaid objects by operating totally hydraulically such as to require very little maintenance (substantially only cleaning), for which maintenance it not being necessary to use particularly specialized labour as would be required for example if electrical equipment were present, and which as is well known would impose problems of water isolation and safety for the maintenance personnel and for the user.

A further object of the invention is to provide a cistern which attains the aforesaid objects while at the same time enabling the consumed additive to be replaced by simple operations and hence without requiring the intervention of specialized personnel.

A further object of the invention is to provide a cistern which attains the aforesaid objects while at the same time being multi-functional by being operable either from close by or at a distance, either by mechanical means or by pneumatic and/or hydraulic means. In this manner the cistern ensures maximum hygiene even if used in toilets for public use or of intense use by different persons.

The facility for delivering different flows while at the same time being able to be operated either from close by or at a distance makes said flushing cistern suitable also for installation in toilets for handicapped persons.

A further object of the invention is to provide a cistern which attains the aforesaid objects while at the same time having a structure which can be constructed in a version either for mounting on the surface of a vertical wall or for building into the wall itself even if this has a thickness not exceeding 10 cm.

A further object of the invention is to provide a cistern which attains the aforesaid objects while at the same time being constructable in more simple and hence economical versions by simply not providing it with certain mechanisms which (as will be apparent from the ensuing description) have been designed to be added or removed without compromising the basic operation of the cistern, for example such as the various types of remote control and/or the various methods of delivery. In this manner the range of production of said flushing cisterns can be extended while at the same time reducing the pieces to be constructed and mounted, so obtaining substantial savings in terms of production and stocking of spare parts.

A further object of the invention is to provide a cistern which attains the aforesaid objects while at the same time being completable even after its installation by the addition of devices which enable its performance in terms of water saving and increase in sanitizing power at each flush to be increased.

These objects are attained by a water-closet flushing cistern in accordance with claim 1, to which reference should be made for brevity. By selectively operating the three pushbuttons the flushing cistern delivers at choice two different flows of flushing water to

which, at choice, an additive has or has not been added. The object of improving and facilitating cleansing and hygiene of the bowl while substantially reducing water consumption is hence attained.

This and the other objects will be more apparent from the ensuing description given with reference to relative drawings. The description and drawings are provided by way of non-limiting example in that they relate to a preferred embodiment in the form of a water-closet flushing cistern of built-in type, in which respect the invention is not limited to built-in cisterns but can also be applied to cisterns for external mounting.

Figure 1 is a partial front view of a cistern according to the invention.

Figure 2 is a partial section on the line II-II of Figure 1.

Figure 3 is a partial section on the line III-III of Figure 1.

Figure 4 is a section on the line IV-IV of Figure 2.

The water-closet flushing cistern, indicated overall by 1 in the said figures, is of the built-in type. It comprises essentially a container 2, a water feed conduit 3, a float valve 4, a first valving element 5, an additive dispensing device 6, a hydraulic device 7 for closing the first valving element, a first plate 8, and a second plate 9.

The container 2 is provided with a filling port 10, a discharge port 11 for the flushing water, holes 12 for its mechanical fixing to a support structure (not shown but usually a wall of a building) and, upperly, an aperture 13 of such a form and size as to enable the internal hydraulic members described hereinafter to be inserted and mounted. The water feed conduit 3 connects the filling port 10 to the container interior, which can hence be supplied with the water required for flushing. In the illustrated embodiment the feed conduit has a first end hydraulically connected to a cock 14 and its second end to the float valve 4.

The float valve 4 is of known type and is consequently not described in detail. Its purpose is to halt the water flow through the feed conduit 3 when the water in the container 2 reaches the maximum predetermined level, indicated by L in Figure 4. In Figure 4 the hydraulic members within the container 2 are shown in their rest position, ie the stand-by position which they assume when the water is at rest at its maximum level. The valve 4 is closed by the action of the relative first float 15, to interrupt flow through the conduit 3. The first valving element 5, for the flushing water discharge port 11, comprises an overflow tube 16, the upper end 17 of which lies at a higher level than the maximum predetermined level L. The valving element 5 maintains the flushing water discharge port 11 closed by gravity via a lowerly positioned gasket 18. The valving element 5 is also of known type and is consequently not described in detail. It is opened in traditional manner by being lifted along its axis 19.

The additive dispensing device (see Figure 1) com-

prises a reservoir 20 provided with a normally closed valve 21 positioned above a collection tray 22 for the additive (see Figures 2 and 4).

The valve 21 is provided with a valving element openable by a first lever 25 operated by a first pushbutton 26. The dispensed additive falls onto a chute 66 which transports it by gravity into the collection tray 22. The base 23 of said collection tray 22 is provided with a second shut-off valve 24 which, as a result of the lowering of the water level L in the container 2, opens by the operation of the hydraulic device 7, which also closes the first valving element 5 as explained hereinafter. The second shut-off valve 24, which closes the tray 22 in which the dose of additive is temporarily collected, and the relative second valving element 27, are positioned on the vertical axis of the overflow tube 16.

The second valving element 27 has an axial hole so that any excess additive dispensed falls by gravity into the water-closet bowl by passing through the overflow tube 16. This prevents any excess additive being able to fall into the flushing water contained in the container 2, to change the specific gravity of the flushing water and cause abnormal operation of the cistern which, as can be seen, operates totally hydraulically and may hence be sensitive to possible density variations of the liquid which it delivers. The hydraulic device 7 is arranged to cause early closure of the first valving element 5 of the flushing water discharge port 11 on the basis of a predetermined change in the level L of the water within the container 2, and to simultaneously operate the additive dispensing device 6. The hydraulic device 7 comprises essentially at least one vertical guide 28, a slidable frame 29 and a ratchet 30. The vertical guide 28 is rigid with the container 2. The frame 29 is slidable vertically on said vertical guide 28 under the action of a second float 31. The position of the second float 31 relative to the vertically slidable frame 29 is adjustable by screw means comprising a threaded rod 34 rigid with the float and engaged by a nut 35 free only to rotate on the slidable frame 29.

The operation of the dispensing system will be apparent hereinafter. The frame 29 comprises a first portion 32 and a second portion 33. The first portion 32 is arranged to urge into closure the first valving element 5 which closes the discharge port 11 of the container 2, the second portion 33 maintaining the second shut-off valve 24 closed for the closure of the tray 22 in which the dispensed dose of additive is temporarily collected.

In the illustrated embodiment the second valving element 27 of said second valve 24 is urged into closure by a lever 36. The lever 36, which opens the second valving element 27 of the normally closed valve 24 of the additive dispensing device 6, is a first class lever having a first end provided with a weight 37 and arranged to engage the vertically slidable frame 29, and a second end 38 hinged to the second valving element 27, which is closed when the slidable frame 29 supports the weight 37 off the first end.

The ratchet 30 comprises a first portion 39 which rocks about a hinge 40. The first portion 39 comprises a first tooth 46 arranged to engage a first counter-tooth 42 rigid with the vertically slidable frame 29. The first portion 39 also comprises a second tooth 56 arranged to engage a second portion 41 rigid with the slidable frame 29.

The ratchet 30, which as stated is interposed between said slidable frame 29 and the container 2, is positioned such that when inserted it prevents said slidable frame 29 from vertically descending below a height h above the level L, to prevent early closure of the first valving element 5 which closes the discharge port 11 of the container 2, ie before the flushing water has been completely delivered, however it still allows opening of the second valve 24 which closes the tray 22 for the temporary collection of the dispensed dose of additive. The first plate 8 comprises means for supporting the reservoir 20 and the relative valve 21 of the additive dispensing device 6. The first plate is applied to the said aperture 13 of the container 2 to close it.

The first plate 8 supports the first operating lever 25, a second operating lever 44 and a third operating lever 45. The first lever 25 opens the valve 21 of the reservoir 20 of the additive dispensing device 6. The second lever 44 merely operates the first valving element 5 for the flushing water discharge port 11.

The third lever 45 operates both the first valving element 5 for the flushing water discharge port and simultaneously the hydraulic device 7 which closes the first valving element 5 for the flushing water discharge port on the basis of a predetermined change in the level L of the water within the container 2. The second plate 9 is applied to the first plate 8 and is secured to it by pawls 58 pivoted at 59 to the second plate 9. In this manner the second plate 9 can be removed from or applied to the first plate 8 by merely pressing on said pawls 58. Maintenance and the periodic replacement of the reservoir 20 are considerably simplified. The second plate 9 carries a first pushbutton 26, a second pushbutton 47 and a third pushbutton 48 for the selective and exclusive operation of the corresponding respective first lever 25, second lever 44 and third lever 45 positioned on the first plate 8. On the second plate 9 there is also provided a transparent window 54 for inspecting the level of the additive contained in the reservoir 20, which is transparent at least in correspondence with said window. The water-closet flushing cistern comprises a pneumatic cylinder 49, of which the fixed part 50 is rigid with the container 2 and the movable part 51 is rigid with the overflow tube 16 of the first valving element 5, which as is known maintains the water discharge port 11 closed by gravity via the gasket 18.

The cylinder 49 is operated by a pump (not shown), which opens it.

The hydraulic cylinder 49 is hydraulically connected to said pump via an operating conduit 53 which terminates outside the cistern where the pump is located.

The flushing cistern 1 can hence be operated from a distance by pneumatic means. If necessary, with small modifications such means could also be converted into hydraulic means. The cistern of the invention can also be operated from a distance by mechanical means. As is at least partly visible in Figure 3, the flushing cistern of the invention also comprises two mechanical actuators 60 operationally associated with the second lever 44 and third lever 45 respectively. Each mechanical actuator 60 comprises an arm 61 remotely operable by a Bowden cable 62 against the action of a spring 63. The arm 61 comprises perpendicular to it a portion 64 arranged to operate on the respective lever 44 or 45, and slidable on the body 65 of the actuator 60 within a groove, not visible, provided on the body 65.

The water-closet flushing cistern operates in the following manner.

Starting from the configuration shown in Figure 4, the cistern 1 is completely full, the level of the flushing water hence being that indicated by L.

The user has the following four options available to him:

- he can flush using all the water contained in the cistern plus an additive, which can be a detergent, a disinfectant or a detergent-disinfectant;
- he can flush using all the water contained in the cistern but without the addition of an additive;
- he can flush using only a part the water contained in the cistern plus an additive;
- he can flush using only a part of the water contained in the cistern but without the addition of an additive.

In all cases the cistern operation is totally hydraulic, ensuring maximum reliability and minimum operating cost.

In the first case the user presses the first pushbutton 26 to open the valve 21 of the device 6 for the time required to dispense a dose of the additive. Through the transparent window 54 the user can check the fall in the level of the additive contained in the reservoir 20. The withdrawn dose of additive falls by gravity into the collection tray 22 where the valve 24 is closed.

However, if the amount dispensed is excessive the excess quantity of additive falls directly into the water-closet bowl via the second valving element 27, which is provided with a through hole 57 the axis of which coincides with the axis 19 of the overflow tube 16. This prevents the additive being able (by overflowing from the collection tray 22) to mix with the flushing water within the container 2 and changing those hydraulic characteristics essential for proper operation and reliability of the cistern 1.

The user then presses the second pushbutton 47, which moves the second lever 44. That end of the lever 44 distant from the pushbutton 47 engages a hook 55 on the overflow tube 16, which is consequently raised.

The first valving element 5 opens to open the port 11 and deliver the flushing water. The fall in the level of flushing water within the container 2 causes the second float 31 to fall, together with the slidable frame 29 mechanically connected to it. The second portion 33 moves downwards followed by the weight 37, which hence opens the second valving element 27, ie of the valve 24. The additive contained in the collection tray falls into the bowl via the overflow tube 16 and mixes with the flushing water in the bowl. The fall of the second float 31 ceases when the first counter-tooth 42 of the slidable frame 29 engages the first tooth 46. By this means the first portion 32 of the slidable frame 29 does not fall sufficiently to press on the hook 55. The first valving element 5 consequently remains open until all the flushing water has been delivered, which mixes with the additive within the water-closet bowl, as stated. The fall in the level L results in traditional opening of the float valve 4 and gravity closure of the first valving element 5, to allow filling. During said filling, the second float 31 causes the frame 29 to move upwards. The second portion 41 touches the ratchet 30 to push it onto the vertical trajectory of the first counter-tooth 42 (should it not be so positioned), to hence allow repetition of the described delivery procedure.

In the second case, ie if the user wishes to flush using all the water contained in the cistern but without the addition of the additive, the second pushbutton 47 is pressed without firstly pressing the first 26. The operation of the cistern 1 is identical but the additive is not dispensed because the collection tray 22 has not been replenished with it.

In the third case, ie if the user wishes to flush using only a part of the water contained in the cistern plus the additive, he presses the first pushbutton 26 to open the valve 21 of the device 6 for the time required to dispense a dose of additive. Again, through the transparent window 54 the user can check the fall in the level of the additive contained in the reservoir 20. The withdrawn dose of additive falls by gravity into the collection tray 22 where the valve 24 is closed. Again, if the amount dispensed is excessive the excess quantity of additive falls directly into the water-closet bowl both via the second valving element 27, which is provided with the through hole 57, and through the overflow tube 16.

The user then presses the third pushbutton 48, which acts simultaneously both on the third lever 45 and on the first ratchet portion 39.

That end of the lever 45 distant from the pushbutton 48 engages a hook 55 on the overflow tube 16, which is consequently raised. The first valving element 5 opens to open the port 11 and deliver the flushing water. The ratchet portion 39 is urged to rotate on the hinge 40, to cause the first tooth 46 to move inwards and leave the vertical trajectory of the first counter-tooth 42 free.

The ratchet portion 39 is urged to rotate on the hinge 40 by an inwardly projecting portion rigid with the third lever 45.

Unfortunately, for reasons of clarity it is not possible to show this inwardly projecting portion on the drawings.

During delivery of the flushing water through the discharge port 11 the level L of the flushing water within the container 2 falls, to also cause lowering of the second float 31 and hence of the slidable frame 29 which is mechanically connected to it. The second valving element 27 opens and the additive is dispensed.

The first counter-tooth 42 does not interfere with the first tooth 46 which, as stated, has been shifted from its trajectory.

Consequently the slidable frame 29 falls below the height h, so that the first portion 32 presses on the hook 55 to result in early closure of the valving element 5, hence limiting the quantity of flushing water, to which the additive is added within the water-closet bowl. The fall in the level L causes the float valve 4 to open, to again fill the container 2.

During the upward vertical movement of the second float 31 and hence of the slidable frame 29, the second portion 41 interacts with the second tooth 56 to rotate the first ratchet portion 39 about the hinge 40 so that the first tooth 46 returns onto the vertical trajectory of the first counter-tooth 42 in order to be able to intercept and lock it.

In the fourth case, ie if the user wishes to flush using only a part of the water contained in the cistern but without the addition of the additive, he presses only the third pushbutton 48.

The operation of the cistern 1 is similar to the preceding case except that there is no dispensing of the additive as the collection tray 22 has not been filled.

It is important to note that by virtue of the particular structure of the cistern of the invention, when used in the first or third method of flushing, ie when flushing using the additive, the additive is dispensed with some delay compared with the water.

Consequently during these flushing methods there is an initial flow of water without additive, which mainly evacuates excrement from the bowl, followed by a flow with additive, the main purpose of which is to convey the additive onto the bowl surfaces. In this manner the additive effectiveness is maximized as it is not reduced by the presence of excrement. However there is no interruption between the two flows, with the result that there is no reduction in the flushing and transporting action which the flows must provide overall.

Claims

1. A water-closet flushing cistern (1), characterised by comprising:

- a container (2) provided with a filling port (10), a discharge port (11) for the flushing water, holes (12) for its mechanical fixing to a support structure and, upperly, an aperture (13) of such a form and size as to enable the internal

- hydraulic members to be inserted and mounted;
- a water feed conduit (3) connecting the filling port (10) to the interior of the container (2);
 - a float valve (4) for interrupting the water flow through the feed conduit (3) when the maximum predetermined level (L) is attained;
 - for the flushing water discharge port (11) a valving element (5) comprising an overflow tube (16), the upper end (17) of which lies at a higher level than the predetermined maximum level (L), said valving element (5) maintaining the flushing water discharge port (11) closed by gravity via a lowerly positioned gasket (18), said valving element (5) being openable by lifting;
 - an additive dispensing device (6) comprising a reservoir (20) provided with a normally closed valve (21) positioned above an additive collection tray (22), the base (23) of said cylinder being provided with a shut-off valve (24) which opens following a fall in the water level (L) within the container (2);
 - a hydraulic device (7) arranged to close the valving element (5) for the flushing water discharge port (11) on the basis of a predetermined change in the water level (L) within the container (2) and to simultaneously operate the additive dispensing device (6);
 - a first plate (8) comprising means for supporting the additive reservoir (20) and the relative valve (21) of the additive dispensing device (6), said first plate (8) being applicable to said aperture (13) of the container (2) to close it, said first plate (8) supporting a first operating lever (25), a second operating lever (44) and a third operating lever (45), said first lever (25) operating the valving element (5) for the flushing water discharge port (11), said second lever (44) operating the valving element (5) for the flushing water discharge port (11) and simultaneously the hydraulic device (7) arranged to close the valving element (5) for the flushing water discharge port (11) on the basis of a predetermined change in the water level (L) within the container (2), said third lever (45) opening the normally closed valve (21) positioned on the vertical axis of the collection tray (22) of the additive dispensing device (6);
 - a second plate (9) applicable to the first plate (8) and carrying a first pushbutton (26), a second pushbutton (47) and a third pushbutton (48) for the selective and exclusive operation of the corresponding respective first lever (25), second lever (44) and third lever (45) positioned on the first plate (8).
2. A flushing cistern as claimed in claim 1, characterised in that the additive dispensing device (6) comprises essentially an additive reservoir (20), a normally closed valve (21) provided with a valving element openable by means of a lever (25), a tray (22) for the temporary collection of the dispensed dose of additive, and a tray closure valve (24) controlled by the hydraulic device (7) which closes the valving element (5) on the basis of a predetermined change in the water level (L) within the container (2).
3. A flushing cistern as claimed in claim 2, characterised in that the valve (24) for closing the tray (22) for the temporary collection of the dispensed dose of additive and hence the relative valving element (24) are positioned on the vertical axis of the overflow tube (16), its valving element (5) being axially holed so that any excess dispensed additive falls by gravity into the water-closet bowl by passing through the overflow tube (16).
4. A flushing cistern as claimed in claim 1, characterised in that the hydraulic device (7) for closing the valving element (5) on the basis of the level (L) reached by the water within the container (2) with simultaneous dispensing of the additive comprises:
- at least one vertical guide (28) rigid with the container (2);
 - a frame (29) slidable vertically on said vertical guide under the effect of a float (31), and comprising a first counter-tooth (42) and a second portion (41) which are respectively arranged to close the valving element (5) which closes the discharge port (11) of the container (2) and to close the valve (24) which closes the tray (22) for the temporary collection of the dispensed dose of additive;
 - a ratchet (39) interposed between said slidable frame (29) and the container (2), and positioned such that when inserted it prevents said frame (29) from descending below a height such as to cause closure of the valving element (5) which closes the discharge port (11) of the container (2), while still allowing opening of the valve (24) which closes the tray (22) for the temporary collection of the dispensed dose of additive.
5. A flushing cistern as claimed in claim 4, characterised in that the position of the float (31) relative to the vertically slidable frame (29) is adjustable.
6. A flushing cistern as claimed in claims 2 and 4, characterised in that the lever (36) which opens the valving element (27) of the normally closed valve (24) of the additive dispensing device (6) is a first class lever having a first end provided with a weight

(37) and arranged to engage the vertically slidable frame (29), and a second end hinged to the valving element (27) which is closed when the slidable frame (29) supports the weight (37) of the first end.

- 5
7. A flushing cistern as claimed in claim 4, characterised in that the ratchet (39) comprises a first portion rotating about a hinge (40) which renders it rigid with the vertical guide (28), said rotating portion comprising a first tooth (46) and a second tooth (56) 10 which are arranged to cooperate with a first counter-tooth (42) and a second portion (41) both located on the slidable frame (29).
- 15
8. A flushing cistern as claimed in claim 7, characterised in that the valving element (5), which comprises an overflow tube (16) and maintains the discharge port (11) for the flushing water closed by gravity, is associated with a pneumatic cylinder (49) 20 which causes it to open, said pneumatic cylinder (49) being pneumatically connected via a conduit (53) to an operating pump external to the cistern (1).
- 25
9. A flushing cistern as claimed in claim 1, characterised by comprising two mechanical actuators (60) operationally associated with the second lever (44) and third lever (45) respectively, each mechanical actuator (60) being operated by a Bowden cable. 30
- 35
10. A flushing cistern as claimed in claim 9, characterised in that each mechanical actuator (60) is of the type comprising an arm (61) remotely operable by a Bowden cable against the action of a spring (63), said arm (61) comprising, perpendicular to it, a portion (64) arranged to act on the respective lever (44) or (45) and slidable on the body (65) of the actuator (60) within a groove provided on the body (65). 40
- 45
11. A flushing cistern as claimed in claim 1, characterised in that the second plate (9) is provided with a transparent window (54) for inspecting the level of the additive contained in the reservoir (20), which is transparent at least in correspondence with said window (54). 45
- 50
12. A flushing cistern as claimed in claim 1, characterised in that the second plate (9) is applied to the first plate (8) and is secured to it by pawls (58) pivoted at (59) to the second plate (9) so that the second plate (9) can be removed from or applied to the first plate (8) by merely pressing on said pawls (58). 50

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Fig.1

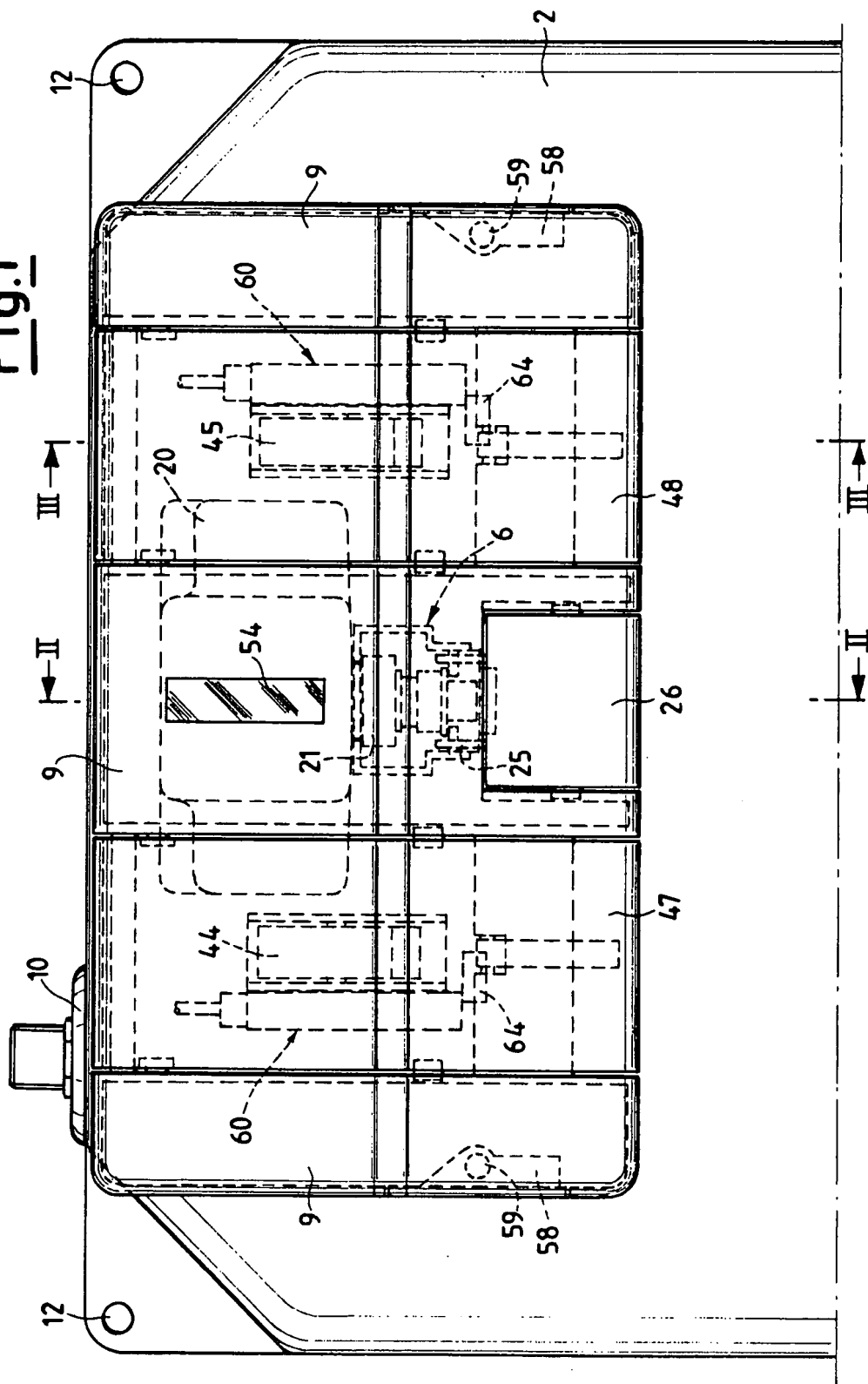


Fig.2

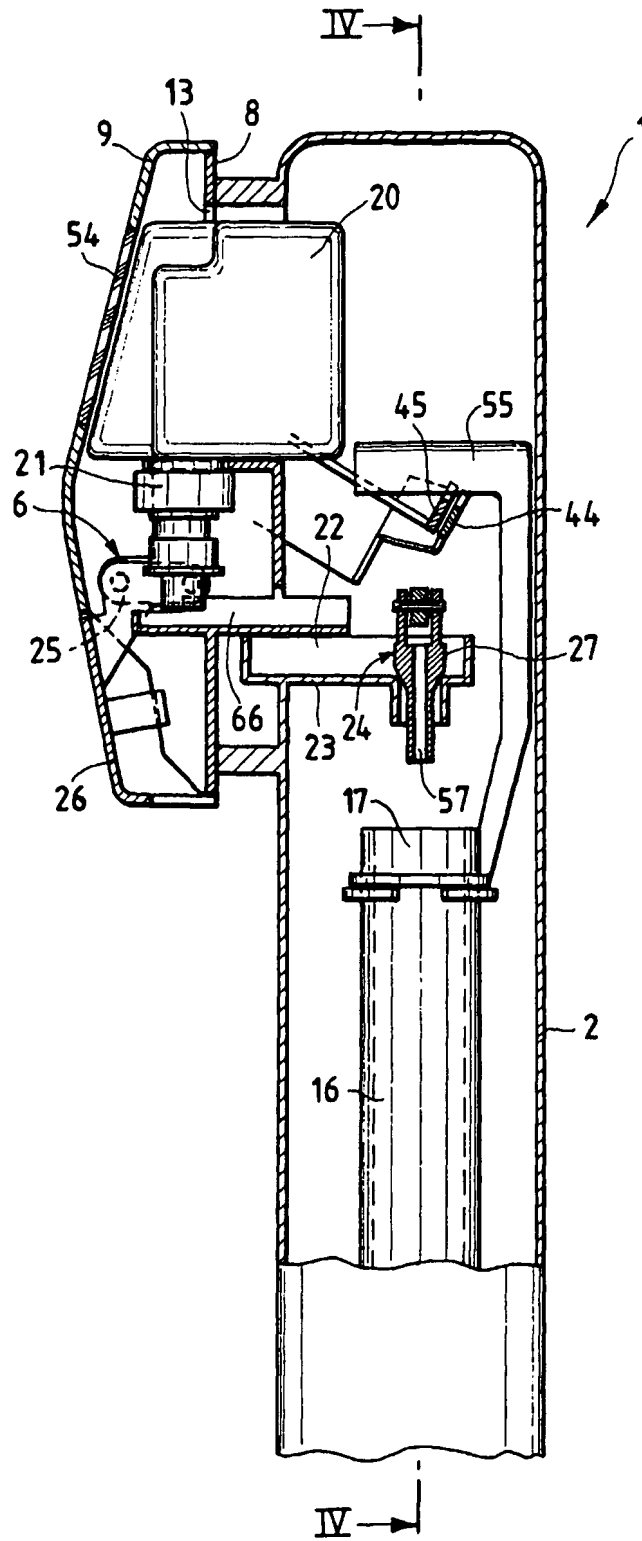


Fig.3

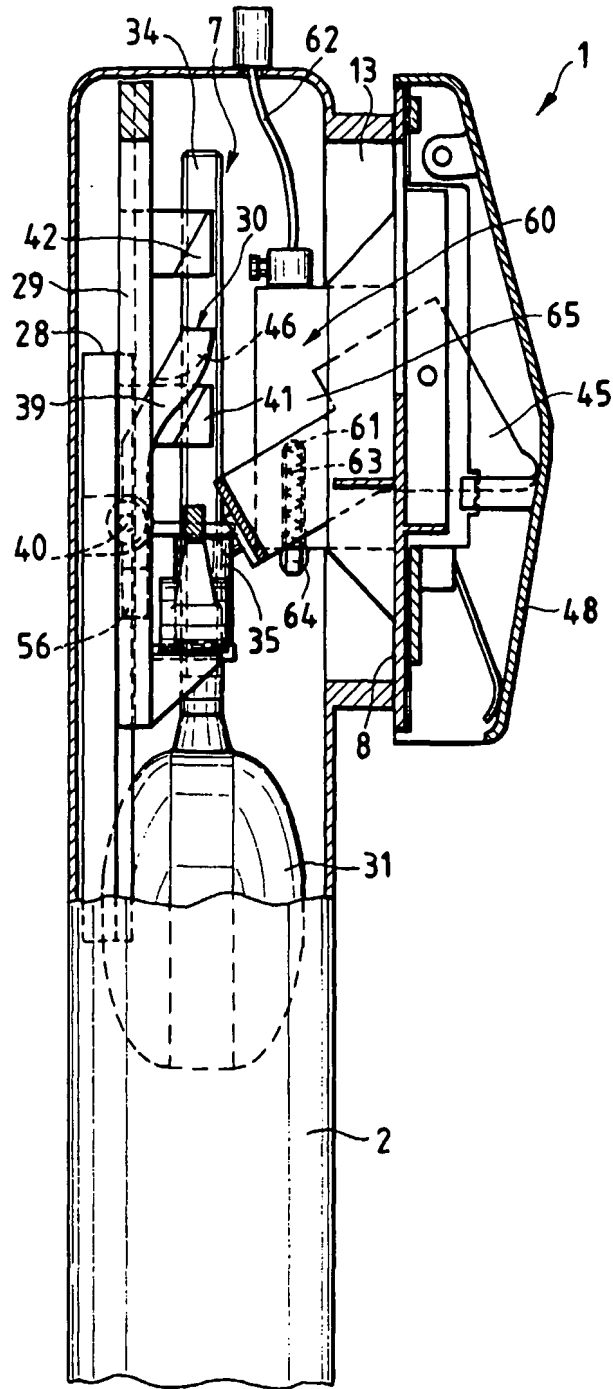


Fig.4

